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# EVALUATION OF FLUXCTURAL PROPERTIES OF ALUMINIUM, BORASSUS FLABELLIFER FIBER AND POLYESTER COMPOSITES

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**Abstract-** The use of natural fibres like borassus flabellifer fiber, flax, sisal, jute, kenaf, etc. as replacement to manmade fibres in fibre-reinforced composites have increased now a days due to advantages like low density, low cost and biodegradability. But the natural fibres have poor compatibility with the matrix and they have relatively high moisture sorption. In this research, the standard test method of ASTM D638M-89is used to prepare specimens as per the dimensions for testing tensile properties of fiber-resin composites. The test specimen has a constant cross section with tabs bonded at the ends. The specimens were incorporated with borassus flabellifer fiber. Five identical specimens were prepared for each weight by varying fiber content in grams i.e. 0.5, 1.0, 1.5, 2.0, 2.5. Tensile strength of fabricated composites increases with increase in weight of fiber. The tensile properties of pure polyesters are also determined experimentally. The tensile strength of pure polyester is 35.2 $N/mm^2$.The tensile strength of a fibered composite is 64.51 $N/mm^2$ (for maximum loading fiber that is at 2.5 grams).

**Keywords:** Composite, Natural Fibre, Tensile strength

## 1. Introduction

With the increased trend for sustainable and environmentally friendly materials, polymer composites industries has lead towards bio degradable polymers from renewable resources such as PVA (polyvinyl alcohol).Biopolymers offer environmental benefits such as biodegradability, greenhouse gas emissions, and renewability of the base material. Bio-composites are usually fabricated with biodegradable/ non-biodegradable polymers as matrix and natural fibers as reinforcement. Many lignocellulosic fibers, such as jute, hemp, sisal, abaca etc. are used as reinforcement for biodegradable bio-composites because of their good mechanical properties and low specific mass. has received much attention of biodegradable polymers. PVA is linear aliphatic thermoplastic polyester, produced from renewable agricultural resources. PVA has properties that are competitive to many commodity polymers (e.g. PP, PE, PLA, PS) such as high stiffness, clarity, gloss, and UV stability. A way to improve the mechanical and thermal properties of PVA is the addition of fibers or filler materials. Combining PVA with natural fibers which are abundantly, readily available such as kenaf, jute, sisal etc. can lead to a totally bio degradable composite made only from renewable resources.

1. Bast or Stem fibres (jute, mesta, banana etc.)

2. Leaf fibres (Palmyra palms, Elephant grass, sisal, pineapple, screw pine etc.)

2. Fruit fibres (cotton, coir, oil palm etc.).

## 3. EXPERIMENTAL PROCEDURE

### *2.1 Materials:*

Palmyra palms are economically useful and widely cultivated in tropical regions. The Palmyra palm has long been one of the most important trees of Cambodia and India where it has over 800 uses. The leaves are used for thatching, mats, baskets, fans, hats, umbrellas, and as writing material and PVA (polyvinyl alcohol).

- Aluminum
- Borassus flabellifer fiber
- Polyester

### *2.2* Extraction of Fiber

Fiber is available in the form of bract on a Palmyra tree .First collect dried bracts from the Palmyra tree then after segregate fibers from the bract then after Fibers are cleaned and dried under sun for two days to remove moisture content. Further, the fibers were kept in oven for 2 hours at $70^0$ C to ensure that maximum moisture was removed. The above fibers extracted by different methods are used for making composite specimens. In this work I took Palmyra bract fiber these are generally 40 cm long.

### *2.3 Composite Fabrication*

The test specimen has a constant cross section with tabs bonded at the ends. The specimen is prepared by hand layup process in the form of a rectangular strip of 160x13x3 mm thick and ground to conform to the dimensions. The mould is prepared on smooth ceramic tile with rubber shoe sole to the required dimension. Initially the ceramic tile is cleaned with shellac (NC thinner) a spirituous product to ensure clean surface on the tile. Then mould is prepared keeping the rubber sole on the tile. The gap between the rubber and the tile is filled with mansion hygienic wax. A thin coating of PVA (polyvinyl alcohol) is applied on the contact surface of specimen, using a brush. The resulting mould is cured for one hour.

### *2.3 FLUXCTURAL Test*

***FLUXCTURAL Test***s were conducted according to ASTM D638 using a 2 ton capacity - Electronic Tensometer, METM 2000 ER-I model, supplied by M/S Microtech Pune, with a cross head speed of 2mm/min.

## 3. Results and Discussion

The Fluxctural strength and modulus of ***borassus flabellifer fiber*** /PVA as a function of the ***borassus flabellifer fiber*** content are presented in figure 3.1&3.2.

***From figures*** 3.1&3.2, it was observed that the Fluxctural strength of composite increased with increase in the fibre loading up to 2.5 grams weight and the Modulus is given maximum at 2.5 grams of borassus flabellifer fiber/PVA composites.

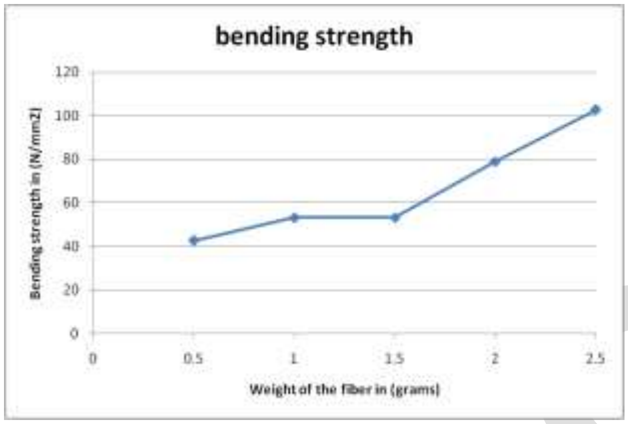


*Figure 3.1: Variation of Bending strength of **borassus flabellifer fiber** /PVA composite with fiber loading.*

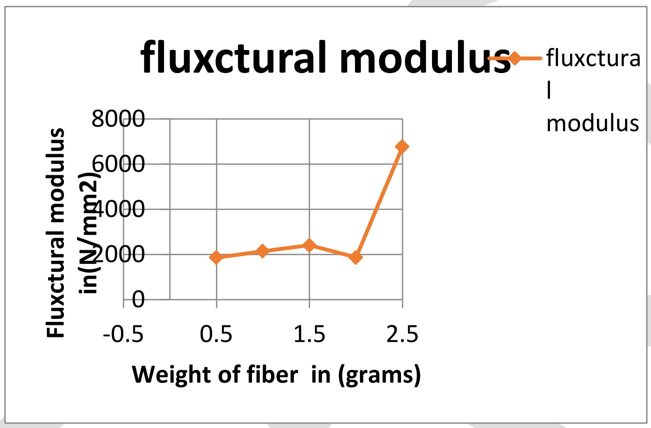


*Figure 3.2: Variation of Fluxctural modulus of **borassus flabellifer fiber** /PVA composite with fiber loading.*

## 4. Conclusions

1. By using chemical treatment we can increase the Tensile, flexural and impact strengths.

2. It can be seen that by varying volume of fiber the mechanical properties of the composite also change. by increase in volume of fiber in composite mechanical properties also increased up to maximum loading.

3. It can be seen that there is an appreciable increase in Tensile properties of chemically treated composite when compared to un treated fibered composites which can be observed from the results below
   - The flexural strength of a fibered composite is 102.73 $N/mm^2$ (for maximum loading fiber).And The Flexural strength of pure polyester is 110.10 $N/mm^2$.
   - The Flexural module of pure polyester is 355.7$N/mm^2$.The flexural module of a fibered composite is 6767.18 $N/mm^2$ (for maximum loading fiber)

## REFERENCES:

[1] Xue Li Æ Lope G. Tabil Æ Satyanarayan Panigrahi: Chemical Treatments of Natural Fiber for Use in Natural Fiber-Reinforced Composites: A Review: J Polym Environ (2007) 15:25–33.

[2] X. Y. Liu, G. C. Dai.: Surface modification and micromechanical properties of jute fiber mat reinforced polypropylene composites: eXPRESS Polymer Letters Vol.1, No.5 (2007) 299–307

[3] Eastham J. : Natural fibres for the automotive industry in ‘Seminar of The Alternative Crops Technology Interaction Network, Manchester, UK’ **16**, 142–146 (2001).

[4] Han S. O., Defoort B., Drzal L. T., Askeland P. A.: Environmentally friendly biocomposites for automotive applications in ‘33rd ISTC Conference, Seattle, USA’ **33**, 1466–1477 (2001).

[5] Marsh G.: Next step for automotive materials. Materials Today, **6**, 36-43 (2003).

[6] Chen Y., Chiparus O., Sun L., Negulescu I., Parikh D. V., Calamari T. A.: Natural fibers for automotive nonwoven composites. Journal of Industrial Textiles, **35**, 47–62 (2005).

[7] Gassan J., Bledzki A. K.: Possibilities for improving the mechanical properties of jute/epoxy composites by alkali treatment of fibres. Composites Science and Technology, 59, 1303–1309 (1999).

[8] Gassan J., Bledzki A. K.: Effect of cyclic moisture absorption desorption on the mechanical properties of silanized jute-epoxy composites. Polymer Composites, 20, 604–611 (1999).

[9] Gassan J., Gutowski V. S.: Effects of corona discharge and UV treatment on the properties of jute-fibre epoxy composites. Composites Science and Technology, 60, 2857–2863 (2000).

[10] Karmaker A. C., Youngquist J. A.: Injection moulding of polypropylene reinforced with short jute fibers. Journal of Applied Polymer Science, 62, 1147–1151 (1996).

[11] Wei-ming Wang; Zai-sheng Cai; jian-yong Yu: Study on Chemical Modification Process of jute. Journal of Engineering fibers and fabrics Volume 3, Issue 2, 2008.

[12] Mohd Zuhri Mohamed Yusoff; Mohd Sapuan Salit; Napsiah Ismail; Riza Wirawan: Mechanical Properties of short random oil palm fiber reinforced epoxy composites. Sains Malaysiana 39(1)(2010): 87-92.

[13] Morsyleide F. Rosa, Bor-sen Chiou, Eliton S. Medeiros: Effect of fiber treatments on tensile and thermal properties of starch/ethylene vinyl alcohol copolymers/coir biocomposites: Bioresource Technology 100 (2009) 5196–5202.

[14] Amel El Ghali, Imed Ben Marzoug: Separation and characterization of new cellulosic fibers from the Juncus acutus L Plant: Bio Resources 7(2), 2002-2018, 2002.

[15] Md Nuruzzaman Khan, Juganta K. Roy, Nousin Akter, Haydar U. Zaman: Production and Properties of Short Jute and Short E-Glass Fiber Reinforced Polypropylene-Based Composites: Open Journal of Composite Materials, 2012, 2, 40-47.

[16] Dipa Ray, B K Sarkar, A K Rana And N R Bose: Effect of alkali treated jute fibres on composite properties: Bull. Mater. Sci., Vol. 24, No. 2, April 2001, pp. 129–135.

[17] H.M.M.A Rashed, M.A. Islam and F.B. Rizvi: Effects of process parameters on tensile strength of jute fiber reinforced thermoplastic composites. Journal of naval architechture and merine engineering, 3(2006) 1-6.

[18] Beckerman G.W., Pickering, K.L., and foreman. N.J.: The Processing, Production and Improvement of hemp fibre reinforced polypropylene composite materials: proceedings of SPPM, 25-27 feb.2004. pp 257-265.

[19] Dieu. T.V., Phai L.T.,Ngoc P.M.: Study on preparation of polymer composites based on polypropylene reinforced by jute fibers: JSME International journal, Series A: Solid mechanics & Material engineering, Vol. 47, No.4, pp 547-550.

[20] Razera I.A.T., and Frollini.E.: Composites based on jute fibers and phenolic matrices: Properties of fibers and composites: Journal of applied polymer science Vol.91, No.2, pp 1077-1085.

[21] Ray D., Sarkar B.K., Rana A.K., Bose N.R.: Effect of alkali treated jute fibres on composite properties, Bulletin of materials science, Vol.24, No.2, pp. 129-135.

[22] M Alamgir Kabir, M. Monimul Huque: Mechanical Properties of Jute fibre reinforced Polypropylene composite: effect of benzenediazonium salt inalkaline edium: bio resources 5(3), 1618-1625